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EVALUATING THE PREDICTIVE VALIDITY OF A SINGLE STIMULUS ENGAGEMENT PREFERENCE ASSESSMENT

LOUIS P. HAGOPIAN, KARENA S. RUSH, ADAM B. LEWIN, AND ETHAN S. LONG

JOHNS HOPKINS UNIVERSITY SCHOOL OF MEDICINE AND KENNEDY KRIEGER INSTITUTE

Most preference assessments require individuals to choose among two or more stimuli. More recently, the duration of engagement with items has been used as an index of preference. In the current study, the predictive validity of a single stimulus engagement (SSE) preference assessment was evaluated with 4 individuals. Stimuli were presented singly for a brief period while engagement with that stimulus was recorded. Although SSE preference rankings closely matched paired stimulus preference assessment rankings for only 2 of the 4 participants, relative preference rankings based on duration of engagement predicted relative reinforcer effectiveness for all participants in a subsequent concurrent-schedule reinforcer assessment. The SSE procedure took less time to administer than the paired stimulus procedure but produced less stable preference rankings across administrations. The SSE procedure may be appropriate for individuals who have difficulty selecting one stimulus from among two or more stimuli, and it may be well suited for evaluating activities that are difficult to present in a paired stimulus format.

DESCRIPTORS: preference assessment, reinforcer assessment, stimulus engagement

During the past decade, major advancements have been made in the development of procedures to systematically identify preferred stimuli that may function as reinforcers for persons with developmental disabilities (e.g., DeLeon & Iwata, 1996; Fisher et al., 1992). Over that same relatively brief period, conducting a preference assessment has become an almost routine part of the assessment and treatment development process in the field of applied behavior analysis. In general, procedures for assessing preference can be categorized as either approach based or engagement based. Approach-based procedures involve recording the individual's approach responses to stimuli (e.g., Fisher et al.), whereas engagement-based procedures involve recording duration of engagement with stimuli (e.g., DeLeon, Iwata, Conners, & Wallace, 1999).

Approach-based preference assessments include the single stimulus (SS; Pace, Ivancic, Edwards, Iwata, & Page, 1985), paired stimulus (PS; Fisher et al., 1992), and multiple-stimulus-without-replacement (MSWO; DeLeon & Iwata, 1996) procedures. During the SS procedure, stimuli are presented singly, and observers record whether or not the individual approaches each stimulus. One limitation of the SS procedure is that some individuals approach most or all of the stimuli presented, thus producing false positives. The PS procedure involves presenting stimuli in pairs and recording which stimulus the client approaches. This procedure has been shown to yield a preference hierarchy that predicts relative reinforcer effectiveness (Piazza, Fisher, Hagopian, Bowman, & Toole, 1996). The main limitation of the PS procedure is that it takes longer to administer than other types of preference assessments (see DeLeon

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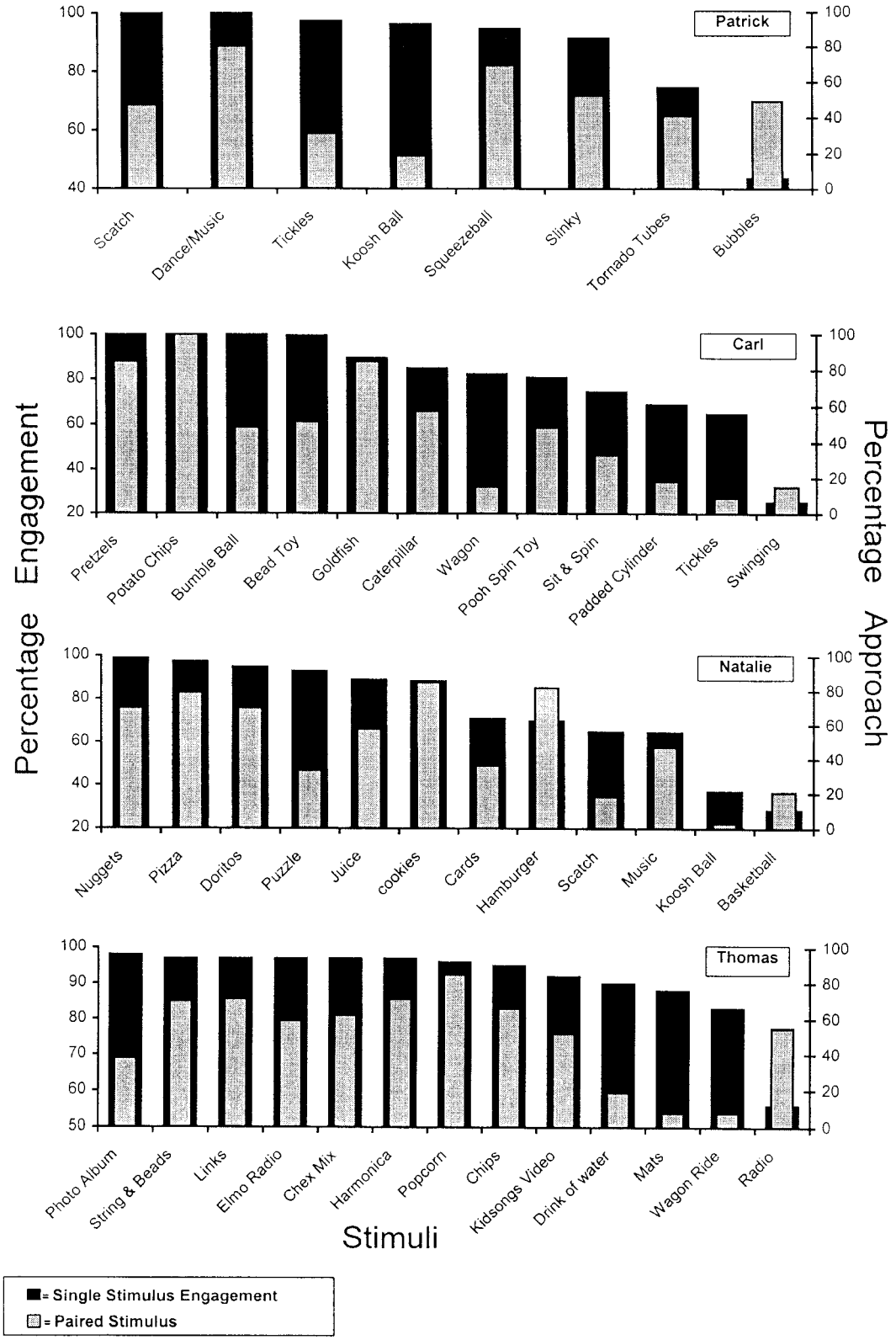
Requests for reprints should be directed to Louis Hagopian, Department of Behavioral Psychology, Kennedy Krieger Institute, 707 N. Broadway, Baltimore, Maryland 21205 (E-mail: Hagopian@kennedykrieger.org).


Patrick
Scatch
Dance/Music
Tickles
Koosh Ball
Squeezeball
Slinky
Tornado Tubes
Bubbles
Carl
Pretzels
Potato Chips
Bumble Ball
Bead Toy
Goldfish
Caterpillar
Wagon
Pooh Spin Toy
Sit & Spin
Padded Cylinder
Tickles
Swinging
Natalie
Nuggets
Pizza
Doritos
Puzzle
Juice
cookies
Cards
Hamburger
Scatch
Music
Koosh Ball
Basketball
Thomas
Photo Album
String & Beads
Links
Elmo Radio
Chex Mix
Harmonica
Popcorn
Chips
Kidsongs Video
Drink of water
Mats
Wagon Ride
Radio
Percentage Engagement
Percentage Approach
Stimuli
■= Single Stimulus Engagement
▨= Paired Stimulus

& Iwata, 1996; Roane, Vollmer, Ringdahl, & Marcus, 1998). For the MSWO procedure, the client is instructed to select one item from among several stimuli presented simultaneously in an array. Once an item has been selected, it is removed from the array on subsequent trials. The MSWO procedure has been shown to have the predictive validity of the PS procedure but requires less than half the time to administer. One limitation of the MSWO procedure is that the participant must fully scan an array of several stimuli prior to making a selection. This requirement may decrease its utility for individuals with severe mental or physical disabilities or problems with impulsivity.

More recently, engagement with stimuli rather than approach has been used as an index of preference during single stimulus and multiple stimulus procedures (e.g., DeLeon et al., 1999; Roane et al., 1998). DeLeon et al. evaluated the use of a single stimulus engagement (SSE) preference assessment to clarify ambiguous results obtained with the MSWO procedure. Items were presented singly for 2 min, during which engagement was recorded. The procedure was repeated five times, results were averaged across sessions, and the outcomes were compared with the results of the MSWO procedure. The engagement-based preference assessment revealed a more differentiated preference hierarchy than the MSWO procedure. Furthermore, stimuli that were highly preferred (based on engagement rankings) were shown to function as reinforcers in a subsequent reinforcer assessment.

One advantage of engagement-based procedures over approach-based procedures is that they may permit one to evaluate stimuli and activities not readily presented in a PS format (e.g., dancing, going for a walk). In addition, the SSE preference assessment described by DeLeon et al. (1999) may be well suited for individuals who have difficulty selecting among two or more stimuli. Given the potential utility of this type of preference assessment, additional research is needed to examine its validity in predicting reinforcer effectiveness.

Although DeLeon et al. (1999) demonstrated that high-preference stimuli identified via this procedure functioned as reinforcers, it has not been shown whether relative rankings across the preference hierarchy accurately predict relative reinforcing effectiveness. In the current study, we evaluated an SSE preference assessment similar to that described by DeLeon et al. Results of the SSE were compared with results of the PS procedure. The PS procedure, which has been used as the standard of comparison in previous studies (e.g., DeLeon & Iwata, 1996; Roane et al., 1998), has been shown to reliably yield a preference hierarchy that predicts relative reinforcement effects. In Phase 1, correspondence between the SSE procedure and the PS procedure and the consistency of results across repeated administrations were evaluated. In Phase 2, the predictive validity of the SSE procedure was examined by conducting a concurrent-schedule reinforcer assessment (Piazza et al., 1996) to compare the relative reinforcing value of stimuli ranked as high, medium, and low preference.

GENERAL METHOD

Participants and Setting

Participants were 4 individuals who had been admitted to an inpatient unit for the

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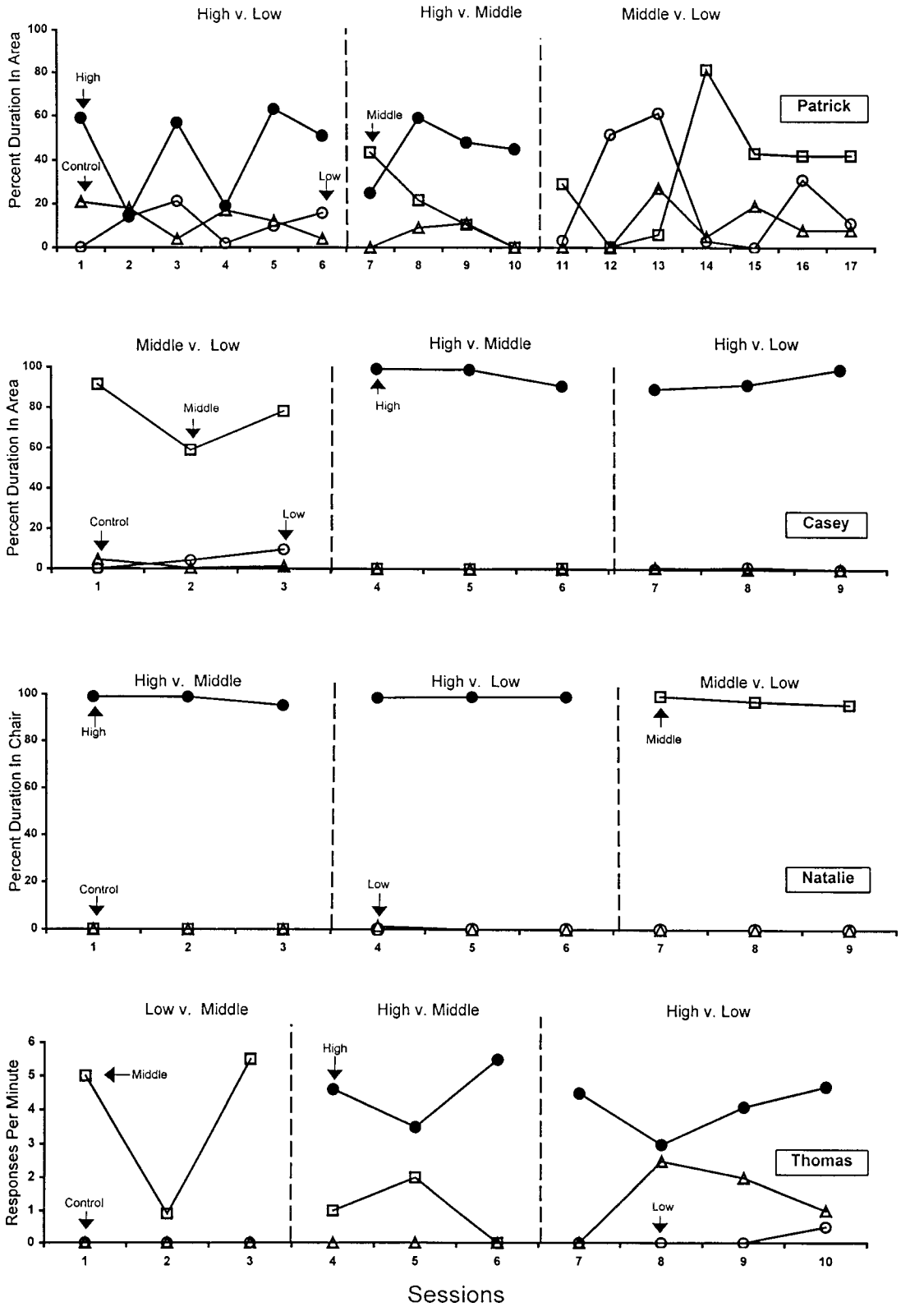
Figure 1. Results of the single stimulus engagement (SSE) and paired stimulus (PS) preference assessments for each participant. Percentage engagement during the SSE is depicted on the left axis, and percentage approach during the PS is depicted on the right axis.


High v. Low
High v. Middle
Middle v. Low
Percent Duration In Area
High
Control
Low
Middle
Patrick
Middle v. Low
High v. Middle
High v. Low
Percent Duration In Area
Middle
Control
Low
High
Casey
High v. Middle
High v. Low
Middle v. Low
Percent Duration In Chair
High
Control
Low
Middle
Natalie
Low v. Middle
High v. Middle
High v. Low
Responses Per Minute
Middle
Control
High
Low
Thomas
Sessions

assessment and treatment of severe behavior problems. Patrick, a 20-year-old man with autism and moderate mental retardation, exhibited aggression and self-injurious behavior (SIB). He was ambulatory and communicated with less than a 10-word vocabulary and a few gestures. Casey, a 7-year-old boy with autism, engaged in SIB, aggression, screaming, and elopement. He was ambulatory, could follow two- and three-step instructions, and used one- and two-word phrases along with gestures to communicate. Natalie, an 18-year-old girl with autism and severe mental retardation, exhibited aggression, dropping to the floor, and disruptive behavior. She was ambulatory, could recognize words of some familiar objects and activities, and could follow one-step commands. Thomas, a 9-year-old boy with autism and severe mental retardation, exhibited aggression, SIB, pica, hyperactivity, and destructive behavior. He communicated predominantly with gestures and occasionally responded to one-step commands.

Phase 1 of the study was conducted in each participant's bedroom on the living unit. Phase 2 of the study was conducted in individual treatment rooms (6 m by 9 m or 3 m by 3 m) equipped with one-way mirrors.

Response Measurement and Reliability

In the PS assessment, approach was defined as the participant moving toward the stimulus, with any part of the body, within 5 s of stimulus presentation. Data were collected on approach responses for each stimulus on each trial. The percentage of trials approached was calculated for each stimulus by dividing the number of trials approached by the number of trials in which that stimulus was presented and multiplying by 100%. In the SSE assessment, stimulus engagement was defined as interaction with the stimulus, moving towards the stimulus, consuming the stimulus (for edible and tangible stimuli), or engaging in the activity (when the stimulus was an activity, such as playing catch with the therapist). The duration of stimulus engagement was recorded using timers. Each 2-min trial was partitioned into four 30-s intervals. At the end of each interval, the observer recorded the number of seconds in which engagement had occurred during that interval. Percentage of engagement was calculated by dividing the total number of seconds of engagement by 120 s and then multiplying by 100%.

Observers also used timers to record the duration of each assessment in its entirety. For the PS procedure, administration time included the presentation time for all possible pairs of stimuli and item-interaction time (i.e., 30 s). For the SSE procedure, administration time included the total time required to present all stimuli, including the 2-min engagement period.

Prior to the reinforcer assessment (Phase 2), an arbitrary response was identified for each participant. For Patrick and Casey, the target response selected was going into one of three areas of a room (areas were of equal size, and marked with tape on the floor). Natalie's target response consisted of sitting in one of three chairs. Thomas' target response was placing tokens into one of three containers. This response was selected because of his extreme hyperactivity and the potential difficulty he may have had in remaining in one chair or one side of the room for any period of time. Observers used lap-

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Figure 2. Results of the concurrent-schedule reinforcer assessment for each participant comparing relative reinforcing effects of high- versus middle-, middle- versus low-, and high- versus low-preference stimuli based on SSE rankings.

top computers to record the duration of time Patrick and Casey spent in each of three areas of the room, the duration of time Natalie sat in each of the three chairs, and the number of times Thomas placed a token in one of three containers.

A second observer collected data during at least 33.3% of the trials or sessions in Phases 1 and 2. However, reliability data were not collected on administration duration. For the PS procedure, interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. An agreement was defined as both observers recording the same response on a particular trial. Mean exact agreement coefficients were 84.2%, 98.9%, 85.6%, and 97.4%, for Patrick, Casey, Natalie, and Thomas, respectively. Interobserver agreement for the SSE procedure was calculated by dividing the smaller duration over the larger duration for each 30-s interval and multiplying by 100%. Mean reliability coefficients were 84%, 99.6%, 84.6%, and 99.2% for Patrick, Casey, Natalie, and Thomas, respectively. For the reinforcer assessment, mean interval-by-interval reliability coefficients were derived by dividing the smaller duration over the larger duration for each 10-s interval and multiplying by 100% (intervals in which neither observer recorded a duration were excluded). These percentages were then summed and divided by the total number of intervals in which at least one observer recorded a duration. Mean interval-by-interval reliability data for the duration of time spent in the areas of the room producing access to high-, middle-, or low-preference stimuli (and no-reinforcement control) were 94%, 91%, and 99% for Patrick, Casey, and Natalie, respectively. For Thomas, mean exact agreement for number of tokens placed in each of the containers producing access to the high-, middle-, or low-preference stimuli (and no-reinforcement control) was 97.7%. Mean exact agreement was calculated by dividing the number of agreements by the number agreements plus disagreements and multiplying by 100%. An agreement was defined as both observers recording the same response on a particular trial.

Phase 1: Preference Assessments

Procedure

Reinforcer survey. The Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher, Piazza, Bowman, & Amari, 1996) was administered to the care provider of each participant. Based on the responses from the survey, 8 to 13 potentially preferred stimuli were identified for each participant.

Paired stimulus (PS) preference assessment. The PS procedure was conducted with each participant using the procedures described by Fisher et al. (1992). Stimuli were presented in all possible pairs while approach responses were recorded. Following an approach response, the selected item, activity, or food was presented for 30 s. For all participants other than Patrick, this procedure was repeated once per day for 3 days over the course of a week (the PS procedure was administered five times for Patrick). The preference hierarchy was developed by ranking stimuli based on the average percentage of trials approached across the administrations. Repeat administrations of the PS procedure were conducted to compare consistency of results across administrations relative to the SSE procedure.

Single stimulus engagement (SSE) preference assessment. During the SSE procedure, each stimulus was presented singly for 2 min while stimulus engagement was recorded. Stimuli were presented in a randomized order. For all participants other than Patrick, this procedure was repeated once per day for 3 days over the course of a week to examine

how stable preference rankings would be across administrations. As with the PS procedure, the SSE procedure was administered five times with Patrick, and rankings were based on the average of the five administrations. The preference hierarchy was developed based on ranking stimuli according to the mean duration of engagement averaged across all administrations.

Results and Discussion

Across all participants, the PS procedure produced hierarchies with greater variability in percentage of approach across stimuli (see Figure 1). All participants demonstrated high levels of engagement (between 80% and 100%) for 50% or more of the stimuli under the SSE procedure. In particular, high levels of engagement were observed for 10 of 13 stimuli with Thomas and for six of eight stimuli with Patrick.

Spearman rank-order correlation coefficients were calculated to obtain a quantitative index of correspondence across stimulus rankings obtained using the two assessment procedures. Correlations indicated a relatively high level of correspondence between PS and SSE rankings for Casey ($r = .78$, $p = .003$) and Natalie ($r = .61$, $p = .03$). For the other 2 participants, the correlation coefficients were low ($r = .13$, $p = .67$, and $r = .04$, $p = .91$, for Thomas and Patrick, respectively).

The reliability of preference rankings obtained across repeated administrations was compared separately for the SSE and PS procedures. Separate Spearman rank-order correlation coefficients were calculated to compare the correspondence between a single administration and the average of three administrations for each participant. In addition, separate correlation coefficients were calculated for the rankings based on the average of the first two administrations and the rankings based on the average of the three administrations for each participant. The preference rankings based on the initial administration of the PS procedure closely matched those based on the average of the three administrations for 3 of the 4 participants (see Table 1). On the other hand, the results of the initial administration of the SSE closely matched the average of the three administrations for just 1 participant (Casey). Correlations between the average of the first two administrations and the average of the three administrations were statistically significant for 2 of the 4 participants and approached significance for 1 other participant.

Table 1
Spearman Correlations for Rankings Obtained from the First Administration and the Average of Three Administrations, and Rankings from the Average of the First and Second Administrations and the Average of Three Administrations

	PS administrations		SSE administrations	
Participant	1st, avg of 3	1st and 2nd, avg of 3	1st, avg of 3	1st and 2nd, avg of 3
Patrick	.78*	.83*	.63	.61
Casey	.94**	.98**	.81**	.55
Natalie	.82**	.97**	.42	.95**
Thomas	.51	.48	.44	.64*

* $p < .05$, ** $p < .01$.

As noted above, little variability in engagement was observed during the SSE administrations across most stimuli for some of the participants (i.e., some participants engaged with most stimuli more than 90% of the time). As a result, relatively small changes in the percentage of engagement that occurred across administrations sometimes produced large changes in the relative ranking of stimuli. Therefore, additional analyses were conducted on the percentage of stimulus engagement, a more absolute measure of preference. Separate Pearson correlational analyses were performed to examine the reliability of percentage of engagement across administrations of the SSE for each participant. Pearson correlations across

Table 2
Pearson Correlations for Engagement Obtained from the First Administration and the Average of Three Administrations, and Engagement from the Average of the First and Second Administrations and the Average of Three Administrations

	SSE administrations	
Participant	1st, avg of 3	1st and 2nd, avg of 3
Patrick	.95**	.93**
Casey	.72*	.75*
Natalie	.26	.92**
Thomas	.92**	.91**

* $p < .05$, ** $p < .01$.

SSE administrations were higher for percentage of engagement values in contrast to Spearman correlations of relative rankings (see Table 2). The results of the first administration closely matched the results of the three administrations for 3 of the 4 participants. The average based on the first and second administrations closely matched that based on all three administrations for all participants.

The mean PS administration times were 49 min, 62 min, and 69 min for Casey, Natalie, and Thomas, respectively. The mean SSE administration times were 36 min, 41 min, and 63 min for Casey, Natalie, and Thomas, respectively. Administration time was not recorded for Patrick. The SSE procedure required an average of 23% less time to administer than the PS procedure across participants.

Phase 2: Reinforcer Assessment

Procedure

Procedures similar to those described by Piazza et al. (1996) were used to determine if relative rankings of stimuli using the SSE procedure predicted relative reinforcing effectiveness in a concurrent-schedule reinforcer assessment. The SSE preference hierarchy was used to assign groups of stimuli to one of three categories for the reinforcer assessment (high-, middle-, and low-preference stimuli). The two highest ranked stimuli were selected as the high-preference stimuli (for Thomas, the top-ranked stimulus and three stimuli tied for the second highest ranking were selected as the high-preference stimuli). The two lowest ranked stimuli were selected as the low-preference stimuli. The two middle-preference stimuli were between the high- and low-preference stimuli (see Table 3).

Training sessions first were conducted to ensure that the participants could independently emit the target responses. Each training session consisted of 10 trials. Stimuli identified as somewhat highly and moderately preferred (but not selected for the reinforcer assessment) were used during train-

Table 3
High-, Medium-, and Low-Preference Stimuli and Activities for Each Participant

	Preference		
Participant	High	Medium	Low
Patrick	Catch with scatch ball	Tickles	Tornado tube
	Dancing	Slinky	Bubbles
Casey	Pretzels	Caterpillar	Tickles
	Bumble ball	Wagon ride	Swinging
Natalie	Chicken nuggets	Cookies	Koosh ball
	Pizza	Cards	Basketball
Thomas	Photo album	Kidsongs video	Wagon ride
	String and beads	Water	Radio

ing sessions. Prior to each session, the participant was given verbal and gestural instructions about the contingencies (e.g., "If you go in this square, you'll get a ball; if you go in this square, you'll get popcorn; and if you go in this square, you'll get nothing"). During the training trials, if the participant did not emit a target response within 20 s, the therapist prompted the participant to engage in one of the responses using a sequential prompting procedure (consisting of verbal, gestural, and physical prompts). The trial was terminated after the participant engaged in the target response and received 10-s access to the stimulus or ceased emitting the response (i.e., left the square). Training sessions were conducted until the participant responded independently on at least 80% of trials for two consecutive sessions.

The reinforcer assessment consisted of three phases, each of which involved a comparison of the relative reinforcing effects of three consequences. Two brief PS procedures were conducted prior to each session to determine which of the stimuli in each category (high, middle, or low preference) would be used in the forthcoming session. Three response options were concurrently available during each session. One of the three response options produced no programmed consequence (control). The remaining two response options each produced access to a corresponding stimulus that was selected in the brief PS procedure. Prior to the start of each session, participants were shown the stimulus each response would produce. In the high- versus middle-preference comparison, the target response produced access to either a high-preference stimulus, middle-preference stimulus, or no reinforcement (control). The other two phases involved comparisons of high- versus low-preference stimuli and middle- versus low-preference stimuli. The sequence of comparisons was randomly determined for the 1st participant (Patrick). For subsequent participants, the first phase was selected so that it varied across participants. Order of comparisons during the second and third phases was randomly determined.

Results and Discussion

Across all 4 participants, high-preference stimuli produced higher levels of responding relative to both middle- and low-preference stimuli; middle-preference stimuli produced higher levels of responding relative to low-preference stimuli (see Figure 2). In contrast to Casey, Natalie, and Thomas, who consistently demonstrated these patterns across every session, Patrick sometimes allocated more time to the lower ranked stimulus than he did to the more highly ranked stimulus. Despite this variability, the findings obtained during the reinforcer assessment support the validity of the SSE preference assessment in predicting relative reinforcing effectiveness.

GENERAL DISCUSSION

Findings obtained in the current study extend previous research (DeLeon et al., 1999) by suggesting that the relative ranking of stimuli as high, middle, or low preference via the SSE procedure accurately predicted relative reinforcer effectiveness. The results have important clinical implications because the SSE procedure has several potential advantages over other types of assessments. For example, the SSE may be more appropriate for individuals with severe or profound developmental disabilities who have difficulty scanning a large number of items or making choices among items. In addition, the SSE procedure (and other engagement-based preference assessments in general) may take less time to administer than the PS procedure, particularly when assessing large numbers of stimuli. The lengthier stimulus-access time may also be more appropriate for assessing activity reinforcers (e.g., playing a video game) and stimuli that are difficult to

present in a choice format (e.g., singing songs, dancing, going for a walk). Finally, occurrences of problem behavior can be recorded concurrently with stimulus engagement during the access period (Roane et al., 1998). Thus, engagement-based preference assessments can provide information about the preference for a stimulus as well as its ability to compete with reinforcement maintaining problem behavior (Ringdahl, Vollmer, Marcus, & Roane, 1997).

The main disadvantage of the SSE procedure is that some individuals may approach most or all of the stimuli presented, thus restricting the range of relative preferences identified via the assessment. This pattern of responding, which was observed with 2 of the participants (Thomas and Patrick), may indicate the presence of false positives. Because only a subset of items was evaluated in the reinforcer assessment, it is not possible to determine if the SSE falsely identified any items as reinforcers for these participants. Another limitation of the SSE procedure evident in the current study was the variability in the results across administrations. However, more consistent results were obtained by evaluating the absolute duration of stimulus engagement rather than the relative preference ranking.

The SSE procedure also may have limited utility for assessing preference for food. Providing extended access to food items may be unnecessary, precludes running multiple successive trials, and may be undesirable from a nutritional standpoint. In addition, previous research indicated that when tangible and food items were presented in the same assessment, food items displaced nonfood items (DeLeon, Iwata, & Roscoe, 1997). The inclusion of both food and nonfood items in the preference assessments is a potential limitation of the current study.

As noted previously, the SSE procedure took less time to administer than the PS procedure but also produced less stable relative preference rankings. Thus, additional research on the SSE is needed to determine whether longer stimulus-access periods or averaging across results of repeated administrations will lead to more stable preference hierarchies. It also may be useful to systematically examine discrepancies in results obtained via approach-based and engagement-based preference assessments. In light of the number and variety of preference assessment procedures described in the literature, additional research is needed to determine what type of preference assessment procedure is most appropriate in a given situation. For example, factors that might be important to consider when selecting a preference assessment method include the individual's level of cognitive functioning, physical impairment, impulsivity, and ability to tolerate the withdrawal of stimuli after brief presentations. The type of stimulus evaluated (e.g., food vs. nonfood, activities, social interaction) also may be an important consideration.

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STUDY QUESTIONS

1. What is a common feature of most single-, paired-, and multiple-stimulus preference assessments, and what is a limitation of each method?

2. What are some potential advantages of the single stimulus engagement (SSE) method of assessing preference?

3. Briefly describe the paired stimulus (PS) and SSE procedures used in this study.

4. How were preference hierarchies developed based on results of the PS and SSE procedures, and what was the degree of correspondence between these hierarchies?

5. Comment on the consistency of results across administrations of the PS and SSE assessments.

6. Explain the purpose of conducting the reinforcer assessment, and describe the basic experimental arrangement.

7. Summarize the results of the reinforcer assessment.

8. Although both approach-based and engagement-based assessment methods have been useful in identifying preferences, the authors noted that different assessment formats might be preferred under certain conditions. Describe a situation in which it may be advantageous to use an approach-based assessment rather than an engagement-based assessment.

Questions prepared by David Wilson and April Worsdell, The University of Florida